وزارة الصحة
Ministry of Health

PULMONARY REHABILITATION PROTOCOL

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1. Table of Contents

2. List of abbreviations

PR – Pulmonary Rehabilitation

PRC – Pulmonary Rehabilitation Center

MOH – Ministry of Health

COPD – Chronic Obstructive Pulmonary Disease

CAT – COPD Assessment Test

mMRC – Modified Medical Research Council Dyspnea Scale

6MWT – 6-Minute Walk Test

ISWT – Incremental Shuttle Walk Test

6MWD – 6-Minute Walk Distance

ISWD – Incremental Shuttle Walk Distance

ESWT – Endurance Shuttle Walk Test

VO_2Peak – Peak Oxygen Uptake

METs – Metabolic Equivalents

SpO_2 – Peripheral Oxygen Saturation

ABG(s) – Arterial Blood Gas(es)

FVC – Forced Vital Capacity

FEV_1 – Forced Expiratory Volume in 1 Second

PFT(s) – Pulmonary Function Test(s)

NYHA – New York Heart Association (classification for heart failure)

MAP – Mean Arterial Pressure

FiO_2 – Fraction of Inspired Oxygen

PEEP – Positive End-Expiratory Pressure

ICU – Intensive Care Unit

MV – Mechanical Ventilation

RT – Respiratory Therapist

PT – Physiotherapist / Physical Therapist

RN – Registered Nurse

ADLs – Activities of Daily Living

QoL – Quality of Life

SGRQ – St. George's Respiratory Questionnaire

CRQ – Chronic Respiratory Disease Questionnaire

HADS – Hospital Anxiety and Depression Scale

DASS – Depression, Anxiety, Stress Scales

VAP – Ventilator-Associated Pneumonia

KPIs – Key Performance Indicator

3. Definitions

- Pulmonary rehabilitation (PR): is a "comprehensive intervention based on a thorough patient assessment followed by patient-tailored therapies that include, but are not limited to, exercise training, education, and behavior change, designed to improve the physical and psychological condition of people with chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviors.
- A respiratory therapist: is a healthcare professional educated, trained, and licensed to apply scientific principles in the assessment, treatment, and prevention **of** acute and chronic dysfunctions of the cardiopulmonary (heart and lung) system**.**
- A physical therapist (PT): is a healthcare professional who helps individuals restore, maintain, and promote optimal physical function, health, and quality of life.
- Endurance exercise: is a form of aerobic (cardiorespiratory) activity performed continuously over prolonged periods, typically aimed at improving the body's ability to sustain effort (such as walking, cycling, swimming, or dancing)
- Strength exercise: Exercise designed to improve physical strength by applying resistance—such as lifting weights, body-weight movements, isometric holds, or plyometric actions—stimulating muscular, tendon, ligament, and bone adaptation and improving metabolic and cardiovascular function
- Breathing exercises: Therapeutic techniques (such as pursed-lip breathing or respiratory muscle training) intended to enhance respiratory efficiency, reduce breathlessness, and improve pulmonary function.
- COPD (Chronic Obstructive Pulmonary Disease): A chronic, progressive respiratory disorder characterized by persistent airflow limitation, most commonly diagnosed by spirometry, and associated with chronic breathlessness, chronic cough, and impaired lung function.
- Inpatient: a patient admitted to and residing within a hospital or healthcare facility to receive active or significant medical treatment.
- Outpatient: a patient who receives medical services without being admitted to a hospital; treatment or consultation is provided during scheduled visits, and the patient goes home the same day.
- Dyspnea: is a subjective, distressing sensation of breathing discomfort—commonly termed "shortness of breath"—which is especially prevalent and disabling in conditions like COPD
- Quality of Life: is a multidimensional concept reflecting an individual's general well-being, including physical health, psychological state, level of independence, social relationships, and personal beliefs.
- NMES: (Neuromuscular Electrical Stimulation) is a therapeutic intervention that uses electrical impulses delivered via surface electrodes to induce muscle contractions, mimicking voluntary activation pathways, and aiding muscle strength and functional capacity improvements.

- Exercise capacity: is the maximum level of physical exertion that a person can sustain, commonly assessed through clinical measures of cardiopulmonary and musculoskeletal performance.
- Interdisciplinary team: A collaborative group of healthcare professionals from various disciplines (e.g., physicians, physiotherapists, nurses, respiratory therapists, nutritionists, occupational therapists) who coordinate to deliver holistic patient care.

4. Key objectives of Pulmonary Rehabilitation Service

- The primary objectives of the service:
- Establish pulmonary rehabilitation as a fundamental part of managing patients with chronic respiratory diseases, integrated within broader healthcare services.
- Enhance healthcare professionals' understanding of patient eligibility and referral criteria for pulmonary rehabilitation.
- Deliver a timely, safe, and clinically effective intervention aligned with the MOH Quality Standards.
- Improve patients' health-related quality of life, ability to manage breathlessness, functional capacity, and peak exercise performance—thereby reducing disability and limitations caused by chronic respiratory conditions.
- Ensure patients have a positive and supportive care experience.
- Drive continuous quality improvement through international benchmarks.
- Enable hands-on training opportunities for students and promote professional research development in the field of pulmonary rehabilitation and broader medical rehabilitation.
- Pulmonary rehabilitation effectiveness is scientifically proven by:
- Regular PR can decrease the frequency and severity of disease exacerbations, leading to fewer hospitalizations.
- Each session attended reduces 7% in hospital admission.
- By reducing hospital admissions and emergency care, pulmonary rehabilitation can lead to significant healthcare cost reductions.
- PR addresses anxiety and depression, which are common among patients with chronic respiratory diseases, leading to better mental health.
- PR improved exercise capacity and endurance, leading to improved physical performance and quality of life.
- Increased Productivity: Improved health enables patients to return to work or maintain their daily routines, positively impacting the economy.

5. Introduction

Pulmonary rehabilitation (PR) is a structured program combining exercise and education, specifically designed for individuals with chronic lung diseases who experience breathlessness.

It features a tailored and progressively advanced exercise regimen alongside an educational component that empowers patients to better understand their condition and symptoms, supporting effective self-management.

Typically, pulmonary rehabilitation programs run for **six to eight weeks**, consisting of **two weekly sessions**, each lasting approximately two hours. These sessions include personalized aerobic and resistance training, education on disease management, and lifestyle support. Patients are also encouraged to complete additional sessions independently at home to reinforce their progress.

Programs are usually delivered in individual sessions or **small groups of 5 to 8 participants**, held in accessible settings such as local hospitals, rehabilitation centers.

Each course is overseen by a **clinical lead** and delivered by a **multi-disciplinary team** of qualified healthcare professionals, including respiratory therapists, physiotherapists, nurses, and occupational therapists.

Scope

Population: Patients with a confirmed diagnosis of one of the listed chronic respiratory diseases

- COPD
- Severe bronchial Asthma,
- Cystic fibrosis
- Bronchiectasis
- Pulmonary hypertension.
- Respiratory disease due to neuromuscular disease,
- Respiratory disease secondary to musculoskeletal disease.
- Pre- and post-lung transplants or major chest surgeries
- It can also extend to in-hospital patients with acute exacerbation of any of the above diseases and mechanically ventilated patients before the weaning process

Staffing Requirements

Pulmonary physician:

- Must be trained in pulmonary rehabilitation (fellowship)
- To be the medical director overseeing pulmonary rehabilitation:
- Provides ongoing supervision throughout the rehabilitation program, monitors patient progress, adjusts treatment as needed, and addresses any complications or medical issues that arise.
- Develops an individualized treatment plan, which may include exercise training, breathing techniques, medication management, nutritional counselling, and smoking cessation support.
- The plan is created in collaboration with the rehabilitation team to ensure a holistic approach to care.
- To establish a pulmonary rehab clinic for screening and referral to PRP and management, including:
- Conducts a comprehensive assessment of the patient's medical history, physical condition, and pulmonary function to identify specific needs and goals.

- Review pharmacological management. Prescription includes medication, oxygen, etc. This may include diagnostic tests such as pulmonary function tests, ABGs, and O2 therapy requirements, oxygen, etc.

Physiotherapists:

- At least two physiotherapists trained in pulmonary rehabilitation to design and implement exercise
- Conduct initial and periodic assessments to evaluate muscle strength, range of motion, endurance, functional level, and balance.
- Perform the Six-Minute Walk Test to assess functional capacity, monitor therapy progress, and evaluate prognosis.
- Set goals to improve muscle power, flexibility, endurance, and prevent complications of immobility. Educate patients and families on bed exercises and safe transfer techniques.
- Design a physiotherapy plan according to the pulmonary rehabilitation protocol, including stretching, strengthening, endurance training, gait training, balance, and activities of daily living (ADLs) training.
- Reassess patients regularly and update treatment plans accordingly.
- Conduct family meetings to explain the treatment plan, restrictions, updates, and required support.
- Plan discharge in coordination with the multidisciplinary team, transitioning the patient from intensive rehab to outpatient follow-up.

Respiratory therapist: At least two respiratory therapists to perform the following

- Conduct initial and periodic assessments according to department policy.
- Strategies for the management of dyspnea
- Inspiratory muscle training
- Assessment of ambulatory oxygen requirements
- Education about how to use inhalation therapy devices and secretion clearance devices
- Perform the Six-Minute Walk Test to assess functional capacity, monitor therapy progress, and evaluate prognosis
- Manage oxygen systems and delivery devices as per patient needs.
- Perform bronchial hygiene and airway clearance techniques (coughing, percussion, postural drainage, vibration, positive airway pressure, PEP devices).
- Demonstrate respiratory devices and modalities.
- Review pulmonary function tests results before and after the program.
- Provide breathing exercises and training (diaphragmatic breathing, pursed-lip breathing, huff coughing).
- Educates patients and families about the respiratory condition, treatment methods, medication use, inhaler techniques, symptom self-monitoring, and lifestyle modifications.

Clinical Dietitians:

- To assist with nutritional counseling tailored to respiratory health.
- Conduct initial and follow-up assessments by the Dietitian Department policy.

- Educate patients on the risks of malnutrition and guide nutritional approaches to manage their chronic respiratory conditions effectively.

Psychologists:

- To support mental health and coping strategies for patients.
- Conduct initial and periodic psychological and social assessments.
- Screen for depression, anxiety, and stress using the DASS tool or any other standardized assessment tool, as well as panic attacks, providing emotional support as needed.

Occupational therapist:

- Assessment and modification of home environment

Social worker:

- Information and access to support services:
- Offer social support to patients and families to ensure safe discharge and home readiness for the patient's needs, such as transportation

6. Facility Design

- **Space Requirements**: Design a dedicated area including:
  - **Exercise space**: The ideal size for an exercise room in a pulmonary rehabilitation center typically ranges from 60–80 m² (≈ 650–860 ft²)
  - The size of the room depends on the following:
- **Patient Capacity**: Plan for enough space to accommodate 8-12 patients simultaneously, which allows for group exercises and individual attention.
- **Layout**:
  - Ensure sufficient room for various equipment
  - **Safety and Accessibility**: Allow for clear walkways and safe access to equipment, ensuring that patients with mobility issues can navigate comfortably. The facility must be easily accessible to patients with mobility impairments and must include handicap-accessible entrances, restrooms, and pathways
    - Located near or within a healthcare facility for emergency support.
    - Ample parking at entrances and accessible entryways.
  - Separate rooms or partitions for Male/Female activities and private consultations.
  - **Instructor Space**: Include an area for instructors to demonstrate exercises and monitor patients effectively.
  - **Ventilation**: Good airflow is essential, so consider ceiling height and ventilation in the design.
  - Patient education rooms
  - Consultation rooms
  - Recovery areas

- **Infection Control** :hygiene stations and PPE availability.
  - Regular cleaning and disinfection of equipment and surfaces.
  - Isolation policy for infectious patients. Since this population is at high risk of acquiring respiratory infections, a space of 2 meters or more is required between each patient in group sessions.

7. Equipment

The number of equipment will be decided based on the Capacity of patient enrollment.
The following is the list of essential equipment that must be available

- Treadmills/ Stationary bikes or any other aerobic exercise machines
- Resistance training machines
- Mats for stretching and floor exercises
- Oximeters, BP monitor, Weight scales, Height chart
- Weights and resistance exercise equipment (0.5 kg/ 1 kg / 2 kg/ 3 kg/ 4kg/ 5kg/ resistance bands)
- Emergency equipment (crash carts): oxygen cylinders, oxygen delivery devices, salbutamol and spacer devices, normal saline
- Respiratory equipment: Incentive spirometry, Vest/vibration machines, Small Volume Nebulizers, Portable/ wall suction machines
- Available space to conduct walking tests
- Floor cones, chairs

8. Program components

- Curriculum Design: A structured rehabilitation program including exercise training, education sessions, psychiatric and nutritional counseling.
- Patient Assessment Protocols: Implement standardized assessment tools to evaluate patients' needs and progress. This includes documentation of pre- and post-PR assessment
- The assessment of each patient will be documented and shared with the treating physician.
- plan for follow-up or discharge for each patient

9. Eligibility

Candidates for PR generally fall into one of the following groups:

Indications
Outpatient Pulmonary Rehabilitation: Outpatient pulmonary rehabilitation is appropriate for patients who are medically stable, can safely travel to a rehabilitation facility, and do not require intensive monitoring or hospital-level care. These patients typically have chronic respiratory conditions but are not in acute distress . Key characteristics include: · Stable Chronic Respiratory Conditions: · Patients with chronic obstructive pulmonary disease (COPD) in stable

condition (e.g., GOLD stages I-IV, without recent exacerbations).
· Individuals with interstitial lung disease, bronchiectasis, or pulmonary fibrosis who are stable and not oxygen-dependent or only require supplemental oxygen during exercise.
· Post-surgical patients (e.g., lung resection or transplant) who have recovered sufficiently to be discharged but need ongoing rehabilitation.
· Functional Status:
· Able to perform daily activities with mild to moderate limitations (e.g., dyspnea on exertion but not at rest).
· No significant comorbidities requiring acute medical intervention (e.g., uncontrolled heart failure or severe infections).
· Capable of participating in 1-2 hour sessions, 2-3 times per week, involving exercise, education, and self-management training.
· Other Criteria:
· No recent hospitalizations (e.g., within the last 2-4 weeks) for acute exacerbations.
· Adequate home support or ability to travel to an outpatient facility. Motivated and able to adhere to a structured program lasting 6-12 weeks.

Patients Requiring Inpatient Pulmonary Rehabilitation
Inpatient pulmonary rehabilitation is reserved for patients who are medically unstable, have severe disease, or require close monitoring and intensive care due to acute or complex conditions. These patients often cannot safely participate in outpatient programs due to their clinical status or logistical barriers. Key characteristics include:
· Acute or Unstable Respiratory Conditions:
· Patients recovering from acute exacerbations of COPD or other respiratory diseases, typically within 48 hours to 2 weeks post-exacerbation.
· Individuals with severe respiratory failure requiring prolonged oxygen therapy or non-invasive ventilation (e.g., BiPAP) that cannot be managed at home.
· Post-ICU patients with significant deconditioning or ICU-acquired weakness transitioning to a step-down unit.
· Severe Functional Limitations:
· Significant dyspnea at rest or with minimal activity, limiting ability to travel or participate in outpatient sessions.
· Severe physical deconditioning or muscle weakness (e.g., unable to walk short distances without assistance).
· High oxygen requirements (e.g., >4 L/min at rest) or need for frequent respiratory interventions (e.g., airway clearance).
· Complex Comorbidities:
· Uncontrolled comorbidities such as heart failure, arrhythmias, or infections requiring hospital-level monitoring.
· Recent major surgery (e.g., lung volume reduction or thoracic surgery) with complications or ongoing recovery needs.
· Logistical or Social Barriers:
· Lack of transportation or home support to attend outpatient sessions.
· Patients in rural areas without access to outpatient pulmonary rehabilitation

facilities. Additional Notes Transition Between Settings: Some patients may begin with inpatient rehabilitation during an acute phase and transition to outpatient programs once they are stabilized. For example, a patient hospitalized for a COPD exacerbation may begin rehabilitation in the hospital and continue in an outpatient setting 2-4 weeks post-discharge to maintain gains.
Significant irreversible airway obstruction with a forced expiratory volume in 1 second (FEV1) of less than 2 L or an FEV1% (ratio of FEV1 to forced vital capacity [FVC]) of less than 60%
combined obstructive and restrictive ventilatory defects
Chronic muco-ciliary clearance defect
Exercise limitations due to severe dyspnea: Patients with a mMRC dyspnea score of 2 or more
• Any patient with Non-respiratory Conditions that has an effect on the Respiratory system and pulmonary function: o work-related exposure to inhaled chemicals or dust o Pre/post major lung surgery or lung transplant o Obesity that impairs the respiratory functions and weakens the respiratory muscle PFT: Restrictive pattern on PFTs with reduced FVC and associated functional limitations or dyspnea • Neuromuscular with a chest wall disorder • Chronic lung symptoms associated with tobacco smoking (Active smokers should enroll in a smoking cessation program before starting PR)
1. Mechanically ventilated patients before the weaning process

Safety criteria

Could be identified clearly include:

- Whether the patient has a stable chronic lung disease or not
- Whether exacerbation or change in medication was identified within last 4 weeks
- History of cardiac disease
- Patient is able to go under exercise test with no safety concerns identified;
- No unstable psychiatric disorders

Contraindications

Absolute

These conditions typically prevent participation due to significant risk:

- Severe cardiovascular instability: Uncontrolled arrhythmias, recent myocardial infarction (within 4-6 weeks), unstable angina, or severe heart failure (e.g., NYHA Class IV).
- Uncontrolled hypertension: Severe, untreated high blood pressure (e.g., systolic >200 mmHg or diastolic >110 mmHg).
- Acute respiratory failure: Conditions requiring immediate mechanical ventilation or unresolved exacerbations of chronic lung disease (e.g., COPD exacerbation with hypercapnic respiratory failure).
- Severe pulmonary hypertension: Unstable or untreated, with risk of syncope or right heart failure during exercise.
- Uncontrolled comorbidities: Such as acute infections, uncontrolled diabetes, or severe metabolic disturbances (e.g., electrolyte imbalances).
- Inability to participate safely: Severe cognitive impairment, untreated psychiatric conditions (e.g., severe psychosis), or physical limitations preventing exercise (e.g., severe orthopedic issues or paralysis)

Relative Contraindications
These conditions may allow participation with modifications or medical clearance:

- Recent cardiovascular events: Stable patients with a history of myocardial infarction or revascularization (e.g., >6 weeks prior) may participate with cardiologist approval.
- Moderate pulmonary hypertension: Patients may be eligible with careful monitoring and tailored exercise intensity.
- Stable comorbidities: Controlled conditions like diabetes, mild heart failure, or arthritis may require adjustments to the program.
- Exercise-induced hypoxemia: Supplemental oxygen can often mitigate this, allowing participation.
- Mild cognitive or psychological issues: Patients with mild dementia, anxiety, or depression may benefit with additional supervision or support.
- Recent surgery: Recent thoracic or abdominal surgery may require a delay (e.g., 6-8 weeks) until cleared by a surgeon.

10. Pulmonary rehabilitation program framework

The program begins with a referral and pre-program assessment, followed by a structured plan that includes exercise, education, behavior change, and nutritional care. It concludes with a post-program assessment to evaluate patient progress and outcomes.

11. Referral process

A pulmonologist shall refer and plan an individual comprehensive assessment based on all the information provided, including:

- Comprehensive medical review of patient to include respiratory history, exacerbations, hospital admissions, and all major co-morbidities
- Current medications
- Social circumstances
- Smoking status and onward referral to smoking cessation services
- Baseline observations – heart rate, blood pressure, height, weight
- Nutritional assessment (including BMI)
- Oxygen requirements
- Assessment of peripheral muscle strength
- Assessment of quality of life, psychological status, and nutritional status using validated
- measure(s), as stated in the BTS Quality Standards
- Assessment of functional status using a validated measure
- Screen to identify those at potential risk of drop out – e.g., where there are musculoskeletal, cardiac, or medication issues

1	DEMOGRAPHICS	age, gender, weight, height
2	PULMONARY DIAGNOSIS	diagnosis, duration, diagnostic tests such as pulmonary function tests, chest x-ray
3	MEDICAL HISTORY	other chronic conditions, focusing on those that can impact participation: cardiovascular, musculoskeletal, anxiety, depression, cognitive disorders, diabetes, pain, obesity/cachexia
4	EXPOSURES	smoking history, occupational history, current exposures, recent exacerbations and admissions
5	SYMPTOMS	dyspnea, cough, sputum, wheeze, pain, fatigue, sleep

Referrals to the program can only be initiated by a pomologist. A Pulmonary Rehab Referral form should be completed. Appendix 1

12. Pre-program assessment

These assessments are conducted at the pulmonary rehabilitation site by the rehabilitation team, PT/RT, after the patient has been referred to the program.

The program should contain at least two nutritional consultation visits or more as needed, including essential nutritional assessment pre and post program, and two visits for psycho/social workers that should also include pre and post program assessments, and any additional visits as needed to address raised psychological or social issues.

Assessment Tools for Pulmonary Rehabilitation Outcome Evaluation

Mandatory tools:

- Aerobic exercise testing
- Modified Medical Research Council (mMRC) Dyspnea Scale
- COPD Assessment Test (CAT)
- St. George's Respiratory Questionnaire (SGRQ): A disease-specific tool measuring symptoms, activity, and impact on daily life
- Sit-to-Stand Test: Assesses lower body strength and endurance
- Borg Scale: Measures perceived exertion and breathlessness during exercise
- Chronic Respiratory Disease Questionnaire (CRQ): Measures QoL across domains like dyspnea, fatigue, and emotional function.
- Depression Anxiety Stress Scales (DASS) OR Hospital Anxiety and Depression Scale (HADS)
- Any valid and reliable assessment tools used by PT

Assessment of exercise capacity with the correct number of practice tests to achieve validity (6-minute walk tests, or incremental shuttle walk tests over an appropriate length course (30m or 10m respectively) with measures of oxygen saturation and breathlessness.

Pre-program assessments are: Aerobic Exercise Testing - The Six Minute Walk Test and the Shuttle Walk Test. CAT, and mMRC scale.

Aerobic Exercise Testing

All pulmonary rehabilitation participants must undergo a direct assessment of their aerobic exercise capacity. Conducting a safe and informative exercise test before initiating pulmonary rehabilitation is an important indicator of a quality rehabilitation program. Fortunately, there are exercise tests which are not complicated, are feasible in most rehabilitation settings, and need few resources, yet they provide the necessary information to develop a safe and effective exercise prescription.
The six-minute walk test and the incremental shuttle walk test are two validated tests of exercise capacity commonly used in pulmonary rehabilitation. In this section, we will review the reasons to conduct the exercise test, safety considerations, including absolute and relative contraindications, and how to conduct the test.

In this section, we will review safety considerations, followed by the six-minute walk test and the incremental shuttle walk test.

Safety considerations

Any exercise testing must begin with confirmation of the safety of the test for a given patient
Absolute contraindications

- Acute myocardial infarction (3–5 days)
- Unstable angina
- Uncontrolled arrhythmias causing hemodynamic compromise
- Syncope
- Active endocarditis
- Acute myocarditis or pericarditis
- Symptomatic severe aortic stenosis
- Uncontrolled heart failure
- Acute pulmonary embolus or pulmonary infarction
- Thrombosis of lower extremities
- Suspected dissecting aneurysm
- Uncontrolled asthma
- Pulmonary oedema
- Room air SpO2 at rest ≤85%
- Acute respiratory failure
- Acute noncardiopulmonary disorder that may affect exercise performance or be aggravated by exercise (i.e., infection, renal failure, thyrotoxicosis)
- Mental impairment leading to the inability to cooperate

Relative contraindications

- Left main coronary stenosis or its equivalent
- Moderate stenotic valvular heart disease
- Severe untreated arterial hypertension at rest (200 mmHg systolic, 120 mmHg diastolic)
- Tachyarrhythmias or bradyarrhythmia
- High-degree atrioventricular block
- Hypertrophic cardiomyopathy
- Significant pulmonary hypertension
- Advanced or complicated pregnancy
- Electrolyte abnormalities
- Orthopedic impairment that prevents walking

Once you have confirmed the patient's safety to complete an exercise test, you can assess the patient's exercise capacity. An evidence-based program conducts a valid, standardized test of exercise capacity for

each pulmonary rehabilitation participant. The six-minute walk test and the incremental shuttle walk test have both been validated for use in pulmonary rehabilitation.

Six Minute Walk Test

The 6-MWT is a simple and practical test, used to evaluate walking. It does not provide specific information on each of the systems involved with exercise but it reflects functional capacity. The 6-MWT has good reliability, validity and interpretability as a measure of functional capacity. Appendix 2,3

Safety and Emergency Preparedness for 6-Minute Walk Test (6MWT)

Testing must be conducted in a setting where immediate and appropriate emergency response is possible. The supervising physician is responsible for determining the proper location of the emergency crash cart. Essential emergency supplies that must be readily available include:

- Oxygen
- Albuterol (via metered-dose inhaler or nebulizer)
  Additionally, a functioning telephone or other reliable means of communication must be available to seek emergency assistance if needed.

For patients on long term oxygen therapy, supplemental oxygen should be administered at their usual prescribed flow rate or as specified by a physician or institutional protocol. Technicians must be trained to recognize these warning signs and respond appropriately. If the test is stopped due to any of these symptoms, the patient should be seated or positioned supine based on symptom severity and the technician's clinical judgment to minimize the risk of syncope. The following should be obtained based on the technician's assessment:

- Blood pressure
- Heart rate
- Oxygen saturation
- Oxygen should be administered promptly if clinically indicated.

Procedure:

- Set the lap counter to zero and the timer to 6 minutes. Assemble all necessary equipment (lap counter, timer, clipboard, Borg Scale, worksheet) and move to the starting point.
- Instruct the patient as follows:

"The object of this test is to walk as far as possible for 6 minutes. You will walk back and forth in this hallway. Six minutes is a long time to walk, so you will be exerting yourself. You will probably get out of breath or become exhausted. You are permitted to slow down, to stop, and to rest as necessary. You may lean against the wall while resting, but resume walking as soon as you are able.

You will be walking back and forth around the cones. You should pivot briskly around the cones and continue back the other way without hesitation. Now I'm going to show you. Please watch the way I turn without hesitation."

Demonstrate by walking one lap yourself. Walk and pivot around a cone briskly.

"Are you ready to do that? I am going to use this counter to keep track of the number of laps you complete. I will click it each time you turn around at this starting line. Remember that the object is to walk AS FAR AS POSSIBLE for 6 minutes, but don't run or jog.
Start now, or whenever you are ready."

- Position the patient at the starting line. You should also stand near the starting line during the test. Do not walk with the patient. As soon as the patient starts to walk, start the timer.
- Do not talk to anyone during the walk. Use an even tone of voice when using the standard phrases of encouragement. Watch the patient. Do not get distracted and lose count of the laps. Each time the participant returns to the starting line, click the lap counter once (or mark the lap on the worksheet). Let the participant see you do it. Exaggerate the click using body language, like using a stopwatch at a race.

After the first minute, tell the patient the following (in even tones): "You are doing well. You have 5 minutes to go."
When the timer shows 4 minutes remaining, tell the patient the following: "Keep up the good work. You have 4 minutes to go."
When the timer shows 3 minutes remaining, tell the patient the following: "You are doing well. You are halfway done."
When the timer shows 2 minutes remaining, tell the patient the following: "Keep up the good work. You have only 2 minutes left."
When the timer shows only 1 minute remaining, tell the patient: "You are doing well. You have only 1 minute to go."
Do not use other words of encouragement (or body language to speed up).

If the patient stops walking during the test and needs a rest, say this: "You can lean against the wall if you would like; then continue walking whenever you feel able." Do not stop the timer. If the patient stops before the 6 minutes are up and refuses to continue (or you decide that they should not continue), wheel the chair over for the patient to sit on, discontinue the walk, and note on the worksheet the distance, the time stopped, and the reason for stopping prematurely.

When the timer is 15 seconds from completion, say this: "In a moment I'm going to tell you to stop. When I do, just stop right where you are and I will come to you."
When the timer rings (or buzzes), say this: "Stop!" Walk over to the patient. Consider taking the chair if they look exhausted. Mark the spot where they stopped by placing a bean bag or a piece of tape on the floor.

- Post-test: Record the post walk Borg dyspnea and fatigue levels and ask this: "What, if anything, kept you from walking farther?"
- If using a pulse oximeter, measure SpO_2 and pulse rate from the oximeter and then remove the sensor.
- Record the number of laps from the counter (or tick marks on the worksheet).
- Record the additional distance covered (the number of meters in the final partial lap) using the markers on the wall as distance guides. Calculate the total distance walked, rounding to the nearest meter, and record it on the worksheet.
- Congratulate the patient on good effort and offer a drink of water.

Interpretation of 6MWT:

There are reference equations available for you to compare your patient's six-minute walk distance with 'average' values seen in people of the same sex, height, and age. If there is a reference equation that has been generated and validated in a population similar to yours (country, ethnicity, etc.) then use that equation for your rehabilitation program. Six-minutes' walk test distance (6MWD) is the primary outcome (measured to nearest foot or meter).

Conversions:

- Converting distance walked in feet to **meters**:

____feet x 0.0348 =____meters

- Converting distance walked in feet to **speed (mph)**

6MWD (feet) x10÷5280 =____mph

- Expressing 6MWD in METs:

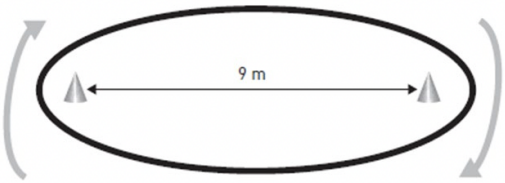
METs= [(mph) (26.83m/min) (0.1mLO2/kg/min) + (3.5mLO2/kg/min)] ÷ 3.5mLO2/kg/min1
(Note: Most accurate for speeds of 1.9-3.7mph)

Incremental Shuttle Walk Test

The ISWT can be used to calculate exercise capacity that is similar to what would be seen if the patient had completed a maximal cardiopulmonary exercise test.

Important Considerations

1. Take the test twice in the same day (effect of learning) - 30 min interval or until the individual recovers' vital signs and symptoms.
2. Do not warm up.
3. 15 minutes of rest before the test.
4. Do not follow the patient during the test as not to dictate the pace.
5. In the case of patients in long-term oxygen therapy who do not have portable equipment, follow the patient behind, avoiding disturbing their pace.
6. Vital signs measurement before and after the test: BP, HR, SpO2, BORG Dyspnea, RPE.



Procedure:

1. Position the cones 0.5 meters before the initial and final marks
2. Have at hand a clipboard to note vital signs and laps
3. Demonstrate the test
4. Position the patient on the starting line (standing)
5. Give the start command and start the timer (check later)
6. Count each lap or each shuttle (at each cone)
7. Do not talk to the patient during the test, except when indicated.

At each triple beep, say:
"Now you need to increase your walking speed"
• During the test, if the patient cannot reach the cone in time, say: "You need to increase your speed to stay on the test"
• Stop the test when:
1. The patient indicates that he is not able to continue
2. You determine that the patient is not able to continue
3. The patient is unable to maintain speed to reach the cone in time, two times in a row
• Note the reason for stopping the test
• Note the number of laps to calculate distance walked in meters, including the last 10-m length that was completed

Interpretation: Appendix 4
Parameters: incremental shuttle walk distance (ISWD) or endurance shuttle walk time (ESWT), and estimated V02peak
Distance Walked (in meters)

- Primary outcome is the total distance walked by the patient.
- Compared to predicted normal values based on age, sex, height, and weight.
- Below-normal values may indicate limited functional capacity and higher disease severity.

Reference Values**:**

- Males (Healthy): ~720–940 meters
- Females (Healthy): ~480–800 meters
- COPD patients often walk <400 meters

Use the table below to obtain an estimated V02peak, based on the distance walked in the ISWT. The VO2peak calculation is based on the formula:

VO2peak (ml/mg/min) = 4.19 + (0.025 x distance {m})

CAT/COPD

The COPD Assessment Test is a validated health status measurement for people with COPD. The test is available as an electronic form that you can access and use. There are 8 questions, Appendix 3, on topics such as symptoms, confidence in leaving the house, sleep quality, and energy level.

Procedure:
Patients indicate on a scale of 0 to 5 the severity of their condition. The range of potential scores is 0 to 40. Interpretation: Appendix 5

Modified Medical Research Council Dyspnea Scale mMRC Scale
The modified MRC Dyspnea Scale is used to measure **functional dyspnea**, or the dyspnea the patient reports **during their usual activities**.
The instructions for the modified MRC Dyspnea Scale are as follows.
1) Show the scale to the patient.

2) Ask them to select one descriptor that they feel best describes their typical level of dyspnea during usual activities. The corresponding number is their modified MRC Dyspnea rating.

Ask the patient to choose the number (grade 0–4) that best describes their experience of breathlessness in daily life.

Grade	Description
0	I only get breathless with strenuous exercise.
1	I get short of breath when hurrying on level ground or walking up a slight hill.
2	I walk slower than people of the same age on level ground because of breathlessness, or I have to stop for breath when walking at my own pace.
3	I stop for breath after walking about 100 meters or after a few minutes on level ground.
4	I am too breathless to leave the house or I am breathless when dressing or undressing.

Interpretation & Use in Practice:

- Grade ≥2 is often used as a threshold for more intensive interventions
- It helps clinicians assess severity of functional limitation due to breathlessness.
- It is quick and easy to administer in both clinical and community settings.

Indirect 1 Repetition Maximum Test

This equation can be used to calculated the 1 Repetition Maximum from the Indirect 1 Repetition Maximum test:
Predicted 1 repetition maximum = weight lifted / (1.0278 - 0.0278n) where weight lifted can be either in pounds or kilograms, and n = number of times the weight was lifted during the indirect test. Or, you can use the bellow link to calculate

https://www.topendsports.com/testing/calculators/1repmax.htm

Procedure
The steps of the test are:

1. Collect your equipment:
    - a selection of dumbbells and ankle cuff weights. A range of 3 lbs to 15 lbs is appropriate for most patients.
    - your data collection form
    - a chair for your patient to sit in
2. Review contraindications and cautions.
3. Explain the test to the patient and gain consent.
4. Demonstrate the test.
5. The patient does 2-3 repetitions of the movement with no weight.
6. Select a weight based on your estimate of the patient's ability, and ask them to lift it with good technique, for several repetitions. If it seems that they will easily get to 10 repetitions, stop the test and select a higher weight

7. Ask the patient to again lift the weight for as many repetitions as possible. Again, if it seems they will easily get to 10 repetitions, stop the test and select a higher weight.
8. Stop the test if the person's technique worsens and/or they can no longer lift the weight through their full range. Record the number of repetitions the person can lift. This number will be used in the exercise prescription

Modified Borg scale (dyspnea)

The Modified Borg Scale, also referred to as the Modified Borg Dyspnea Scale, is a commonly used tool to measure a person's perceived level of breathlessness or exertion during physical activity. It is typically administered during or following exercise to evaluate how intensely the individual feels they are exerting themselves.

Use this scale to rate the difficulty of your patients' breathing. It starts at number 0 where patients' breathing is causing them no difficulty at all and progresses through to number 10 where their breathing difficulty is maximal. Ask your patient: How much difficulty is your breathing causing you right now?

10	9	7	5	4	3	2	1	0.5	0
الحد الأقصى	شديد جدا جدا	شديد جدا	شديد الى حد ما	شديد الى حد ما	معتدل	طفيف جدا	طفيف جدا	طفيف جدا جدا	لا شيء على الاطلاق

Psychosocial Assessment and Intervention- DASS/HADS

The DASS-21 is a psychological screening tool that consists of a set of questions designed to measure the levels of depression, anxiety, and stress in patients. It helps identify emotional or psychological distress that may impact the patient's participation in or response to pulmonary rehabilitation. Appendix 6

The social worker or clinical psychologist is typically responsible for administering the DASS as part of the psychosocial assessment during the initial evaluation. It may also be repeated at the end of the program to assess emotional improvement.

Scoring and Interpretation

Add together the scores in each sub-scale – Depression, Anxiety and Stress. Before interpreting the scores, the summed numbers in each sub-scale need to be multiplied by 2 (this is because the DASS 21 is the short form of the scale).

The DASS is not a clinical instrument and cannot diagnose depression, anxiety or stress. It will give an indication whether any of these issues are having a significant effect on the person's life at present. Should the person score highly on any of the issues, these will need further exploration through conversation and thought may need to be given to a referral to a specialist who could then conduct a clinical interview.

DASS Severity Ratings (Multiply summed scores by 2)

Severity	Depression	Anxiety	Stress
Normal	0 - 9	0 - 7	0-14
Mild	10 - 13	8 - 9	15-18
Moderate	14 – 20	10 – 14	19 – 25
Severe	21 – 27	15 – 19	26 – 33
Extremely Severe	28+	20+	34+

HADS Score for assessing anxiety and depression: Appendix 7

13. Program structure

Exercise Component	
FREQUENCY	Outpatient Setting 2-3 times per week, with sessions lasting 1-2 hours each, for a total program duration of 6-8 weeks. This often includes at least two supervised sessions, with an optional third unsupervised session to encourage regular physical activity. Inpatient Setting (non icu) In an inpatient hospital setting, such as during or immediately following an acute exacerbation (e.g., for COPD), pulmonary rehabilitation is often initiated early— ideally within 48 hours of admission—and conducted daily or as tolerated by the patient, with sessions typically lasting 20-60 minutes. The program duration aligns with the hospital stay, which may range from a few days to 2-4 weeks, and focuses on exercise, breathing techniques, and education to reduce readmissions and improve outcomes. It may transition to outpatient follow-up upon discharge. Inpatient ICU setting: For critically ill patients in the ICU (e.g., those on mechanical ventilation or with severe respiratory failure), pulmonary rehabilitation emphasizes early mobilization and is highly individualized based on patient stability. Sessions are recommended daily or multiple times per day as tolerated, with short durations (e.g., 15-20 minutes per intervention) .
INTENSITY	Individualized exercise prescription
TIME	1-2 hours per session
TYPE	Aerobic, strength, balance/flexibility, breathing exercises
DURATION	Standard Length: 6-12 weeks (most commonly 8 weeks) Shorter Programs: 4-6 weeks, suitable for milder cases, post-exacerbation recovery, or resource-limited settings; less effective for long-term outcomes. Longer Programs: >12 weeks, for severe disease or complex needs; may include maintenance phases with reduced frequency (e.g., 1 session/week) to sustain benefits.
Staff	Outpatient settings: Patient on O2 therapy: 1 RT session + PT session Patient on room air: 1 PT + RN: 1-5 patients/ session + RT session Note: An Exercise monitoring sheet should be completed, Appendix 8,9

Education Component	
FREQUENCY	Once a week, usually after or before the session
TIME	10-15 min
TYPE	Individual or group, with information delivered by educator and the opportunity for discussion, could be a virtual session with available online materials
DURATION	During the rehab program

Behavior Change
Smoking cessation
Energy conservation and stress management
Increasing physical activity

14. Exercise Elements

Warm up exercises

#	Exercise Name	Instructions	Repetitions
1	Neck Rotations	Gently rotate your neck in a circular motion, first to the right, then to the left.	2 times per side
2	Neck Side Flexions	Gently tilt your head towards each shoulder (ear to shoulder), hold briefly.	2 times per side
3	Shoulder Rotations	Roll both shoulders forward and backward in circular motions.	5 times
4	Chest Stretch	Sit slightly forward, feet flat. Place hands on the lower back. Inhale. As you exhale, push shoulders back/down and lift chest.	3 times
5	Trunk Rotations	Sit forward, cross arms over chest. Inhale, exhale and slowly rotate shoulders to the right. Return to center, repeat left.	2 times per side

6	Trunk Side Bends	Sit forward, arms at sides. Exhale, slide one hand down towards the floor, other hand rests on hip. Return to center, repeat on the other side.	2 times per side
7	Seated Marching	While seated, lift one knee at a time in a marching motion.	10 lifts per leg
8	Knee Extensions	While seated, extend one leg out straight, hold briefly, lower. Repeat with the other leg.	2 extensions per leg
9	Heel Raises	While seated or standing with support, raise heels off the floor, then lower.	10 times
10	Standing Marching	Stand and march in place quickly, swing arms for added movement.	30 seconds

---

Strengthen exercises

#	Exercise Name	Instructions	Repetitions	Progressions
1	Half Squat	Stand with feet shoulder-width apart, holding a stable object. Inhale. Exhale and bend knees slowly while keeping back upright. Return to standing.	As tolerated	- Full squat- Squat with weights- Single leg dip
2	Standing Press-Up	Face a wall, one arm's length away. Place palms on wall at shoulder height. Inhale. Exhale and bend elbows to bring nose to wall. Push back to start.	As tolerated	- Use lower surface (e.g. table or worktop)
3	Knee Lifts	Stand holding a stable object. Inhale. Exhale and lift right knee comfortably. Lower and repeat with left leg.	As tolerated	- Hold leg up for 5 secs- Add ankle weights or wear heavy shoes

4	Shoulder Press	Sit with back supported, hold weight at shoulder level. Inhale. Exhale, lift weight overhead, then lower slowly. Repeat with both arms.	As tolerated	- Use both arms simultaneously- Increase weight- Perform standing
5	Hip Abduction	Stand, holding a stable object. Inhale. Exhale and lift right leg to the side, keeping knee straight. Lower slowly. Repeat with left leg.	As tolerated	- Add ankle weights or heavy shoes- Add front and back slow kicks
6	Upright Row	Sit with back supported, weight on lap. Inhale. Exhale, lift weight towards chin, elbows pointing outward.	As tolerated	- Increase weight- Hold weight up for 5 secs- Perform standing
7	Knee Extension	Sit with back supported, weight on leg. Inhale. Exhale, straighten right knee, toes to ceiling. Hold for 3 secs, then lower. Repeat other side.	2–3 per leg to start	- Increase weight- Hold knee straight for longer (e.g. 5 secs)
8	Bicep Curls	Sit with back supported, weight in hand. Inhale. Exhale, bend elbow to lift weight to shoulder. Lower slowly. Repeat with other arm.	As tolerated	- Increase weight- Perform standing- Use both arms simultaneously
9	Endurance Activity	Perform 20 minutes of continuous cardiovascular activity (walking, step-ups, bike, etc.). Stop or slow down if severely breathless.	20 minutes	Increase duration or intensity gradually

For weighted exercises, start with 1 kg and gradually increase the load. Choose a weight that produces a gentle ache or warmth in the working muscles.

Cool down exercises			
#	Exercise Name	Instructions	Repetitions
1	Thigh Stretch	Stand holding a stable object (wall, chair, etc.). Stand on your left leg and bend your right knee, holding your ankle or trouser leg. Gently pull heel toward your bottom, keeping knees together. Repeat on the other side.	Hold 10 sec × 2 per leg
2	Calf Stretch	Stand facing a wall, hands at shoulder height. Step one foot back, keeping heel flat and back knee straight. Bend front knee until you feel a stretch in your back calf. Repeat on the other leg.	Hold 10 sec × 2 per leg
3	Trunk Tilts	Stand or sit upright. Place right hand on your waist, left arm reaching overhead. Lean to the right to stretch the left side. Repeat on the other side.	2 times per side
4	Hamstring Stretch	Sit on the edge of a chair. Stretch one leg forward, knee straight, heel on the floor, toes pointing up. Lean forward gently. Repeat on the other leg.	Hold 10 sec × 2 per leg
5	Chest Stretch	Sit slightly forward in a chair, feet flat. Place hands on the small of your back. Inhale, then exhale while pushing shoulders back and chest out.	3 times
6	Triceps Stretch	Sit comfortably. Reach your right arm behind your head. Use your left hand to gently push your right elbow to feel a stretch in the upper arm. Repeat with the other arm.	Hold 10 sec × 2 per arm

Endurance exercise

- Perform **10 to 20 minutes** of **continuous or interval** cardiovascular activity, based on the **individual patient's ability and tolerance** based on the physician's plan

- Choose from the following options:
  Walking/Treadmill/ Step-ups/ Stationary bike or other aerobic equipment

Adjust intensity according to the patient's response. Start gradually and progress as tolerated.
Important:
If the patient becomes breathless or rates 3–4 on the Modified Borg Scale, stop or reduce intensity until they recover.

Neuromuscular Electrical Stimulation (NMES)
Used for: Patients with muscle weakness

Breathing Exercises

Diaphragmatic Breathing

Method:

- Position the patient comfortably (semi-reclined or sitting).
- Place one hand on the chest and the other on the abdomen.
- Instruct the patient to inhale slowly through the nose, feeling the abdominal hand rise more than the chest hand.
- Exhale slowly through the mouth.
- Repeat for 5–10 minutes, 2–3 times daily.

Pursed-Lip Breathing

Method:

- Have the patient sit in a comfortable position.
- Inhale slowly through the nose for 2–3 seconds.
- Exhale gently through pursed lips (as if whistling) for approximately twice the inhalation time.
- Practice for 5–10 minutes during rest or activities that provoke breathlessness.

Breathing + Stretching Combination

Method:

- Combine deep breathing with upper body stretches to expand the thoracic cage.
- Example: Inhale deeply while raising arms laterally overhead; exhale as arms lower.
- Perform 10 repetitions, 2–3 sessions daily.

15. Nutritional Care in Pulmonary Rehabilitation

Systemic Approach

Nutritional care follows a **systematic, individualized process** provided by a **qualified clinical dietician**, tailored to the **age, health status**, and specific needs of each patient. This approach ensures high-quality, evidence-based nutrition support throughout the patient's treatment journey.

Clinical Dietician

A **Clinical Dietician** is a licensed nutritional health care provider recognized by the Saudi Commission for Health Specialties. They play a key role in managing nutritional status in patients with chronic respiratory conditions.

Nutrition Care Process

- Referral
  - The patient is referred by the attending physician to a clinical dietician for nutritional evaluation and support.
- Nutritional Assessment
  - The dietician performs a comprehensive nutritional assessment, including:
    - Anthropometric measurements
    - Dietary history and intake
    - Clinical condition and metabolic needs
- Nutrition Care Plan
  - Based on the assessment, the dietician sets an individualized plan, which may include:
    - Specialized diets or nutrition formulas
    - Tube feeding initiation and guidance (if needed)
    - Calorie and protein targets, fluid needs, and micronutrient support
- Patient Education
  - Educate patients on:
    - The risks of malnutrition
    - The role of nutrition in managing chronic respiratory diseases
    - Practical dietary strategies to improve energy intake**,** muscle preservation, and overall health

Nutrition Documentation Form, Appendix 10a, b

- Initial Nutritional Assessment and Re-Assessment

These forms are to be updated regularly as part of the ongoing monitoring and adjustment of the care plan.

16. Post program assessment

- Exercise Capacity
  - 6-Minute Walk Test (6MWT): Measures the distance a patient can walk in 6 minutes on a flat surface. It assesses functional exercise capacity and endurance. An increase of ≥30 meters is typically considered clinically significant.
  - The minimum important difference (i.e. improvement) in the distance walked in a 6MWT is 30 metres (95% confidence limits 25 to 33 metres).
  - Incremental Shuttle Walk Test (ISWT): Evaluates endurance by measuring the distance walked at increasing speeds. Used as an alternative to 6MWT.
- Dyspnea (Breathlessness)
  - Modified Medical Research Council (mMRC) Dyspnea Scale: Rates breathlessness from 0 (none) to 4 (severe). A reduction of ≥1 point is clinically meaningful.

- Borg Scale: Measures perceived exertion and breathlessness during exercise (scale 0-10). Used to monitor symptom changes pre- and post-PR.
- Chronic Respiratory Disease Questionnaire (CRQ) Dyspnea Domain: Assesses dyspnea during daily activities.

- Quality of Life (QoL)
  - St. George's Respiratory Questionnaire (SGRQ): A disease-specific tool measuring symptoms, activity, and impact on daily life. A decrease of ≥4 points indicates significant improvement.
  - COPD Assessment Test (CAT): A short, patient-completed questionnaire assessing COPD impact. A reduction of ≥2 points is clinically relevant.
  - Chronic Respiratory Disease Questionnaire (CRQ): Measures QoL across domains like dyspnea, fatigue, and emotional function.
- Muscle Strength and Function
  - Sit-to-Stand Test: Assesses lower body strength and endurance (e.g., number of repetitions in 30 seconds).
- Psychological and Emotional Health
  - Hospital Anxiety and Depression Scale (HADS): Screens for anxiety and depression, common in chronic lung disease. A reduction in scores indicates improved mental health.

Notes

- Clinically Significant Changes: Each tool has established minimal clinically important differences (MCID) to guide interpretation (e.g., 6MWT ≥30m, SGRQ ≥4-point decrease).
- Frequency of Assessment: Outcomes are typically measured at baseline, post- rehabilitation (6-12 weeks), and at follow-up (e.g., 6-12 months) to assess maintenance.

17. Program initiation (in-patient settings)

Prolonged mechanical ventilation may result in ventilator-induced diaphragmatic dysfunction due to diaphragmatic weakness and muscle atrophy, as well as generalized weakness caused by immobility or reduced physical activity. Both conditions can contribute to difficulty or failure in weaning from mechanical ventilation.

Patient Screening Criteria

Patients are eligible for PR only if they meet all of the following:

Parameter	Inclusion Criteria
Duration of MV	≥ 24 hours on mechanical ventilation
Hemodynamic Stability	MAP ≥ 65 mmHg; no vasopressor or low dose only
Oxygenation	SpO_2 ≥ 90%, FiO_2 ≤ 0.4, PEEP ≤ 8 cmH_2O
Neurological Status	Alert or responsive to stimuli, not severely agitated.

Airway	Secured airway, no active bleeding or air leak
Temperature	< 38.5 °C
No recent instability	No seizures, no major arrhythmias, no acute distress, no cardiac instability , no hemodynamic instability

Components of the Rehabilitation Program

For critically ill patients in the ICU (e.g., those on mechanical ventilation or with severe respiratory failure), pulmonary rehabilitation emphasizes early mobilization and is highly individualized based on patient stability. Sessions are recommended daily or multiple times per day as tolerated, with short durations (e.g., 15-20 minutes per intervention) .

Specific components include:

- Positioning changes every 2 hours to prevent complications - Nurse role
- Respiratory muscle training (e.g., threshold loading) once or twice daily, with 5 sets of 6-10 breaths. PT role
- Airway clearance techniques (e.g., oscillatory devices or intrapulmonary percussive ventilation) 3-4 times daily, in sets of 10-15 repetitions. RT role
- Peripheral muscle exercises every 2 days, with 1-3 sets of 4-10 repetitions, for 6-8 weeks if extended ICU stay. Early Mobilization: Start with in-bed activities: progressing to sitting, standing, ambulation as tolerated. Team Collaboration

Safety Criteria and Monitoring

Use a traffic-light system to guide safe rehabilitation:

Traffic-light system	Parameters	Action
Green Zone	$FiO_2 \leq 0.4$, PEEP ≤ 8, $SpO_2 \geq 90\%$, HR 60–120, MAP 65–110, Alert	Safe to Proceed
Yellow Zone	FiO_2 0.4–0.6, PEEP 8–10, SpO_2 88–90%, HR 120–130, Alert	Caution
Red Zone	$FiO_2 > 0.6$, PEEP > 10, $SpO_2 < 88\%$, HR > 130 or < 40, MAP < 65 or > 120, unresponsive, chest pain	Stop

Interdisciplinary Team Coordination

The team includes: critical care physician, respiratory therapist, physical therapist, occupational therapist, dietitian, speech therapist, nurse, social worker. Discussion included in daily rounds required. Document all interventions and patient responses.

Outcome Measures and Quality Indicators

- Weaning assessment used in hospital policy
- Ventilator-free days

- ICU length of stay
- Incidence of ventilator-associated pneumonia (VAP)
- Reduction in ICU-acquired weakness
- Functional mobility at discharge

18. Smoking Cessation Services

Pulmonary rehabilitation should not be offered to individuals who are actively smoking. Smoking cessation booking instructions must first be provided by a pulmonologist. Once the patient has completed the smoking cessation program and provides proof of completion, they may then be referred to pulmonary rehabilitation.

- Smokers reduce their tobacco use or quit smoking as a result of support from smoking cessation services
- Pulmonary rehabilitation after smoking cessation is the ideal time for patients to quit smoking because of the physical, educational and psychosocial support offered by the program.

Booking an Appointment at Smoking Cessation Clinics

To book an appointment at smoking cessation clinics, you can call **937**, use the **"Sehhaty"** or **"Najiz"** mobile applications for a virtual appointment, or visit the **Ministry of Health** website, according to the Ministry of Health.

Steps for Booking an Appointment:
Via the Sehhaty App:

- Download and install the **"Sehhaty"** app on your smartphone.
- Open the app and log in.
- Select "Appointments", then "Book New Appointment".
- Choose **"Smoking Cessation Clinic"** and select a suitable healthcare facility.
- Pick a convenient date and time.
- Confirm your appointment.

Via the Najiz Platform:

- Log in to the Najiz portal using your National Access Account (NAFATH).
- Select the "Appointments" package, then "Book an Appointment".
- Click "Submit New Request", then "Book New Appointment".
- Fill in the appointment details and click **"Confirm Booking**

By Calling 937:

- Call the number **937**.
- Follow the instructions to request an appointment at a smoking cessation clinic.
- Via the Ministry of Health Website:
- Visit the **Ministry of Health** website.
- Search for the smoking cessation clinic appointment service.
- Follow the on-screen steps to book your appointment.

19. **Measured outcomes (KPIs)/ Data.** Appendix 11

Administrative Outcome Indicators

- Number of referrals from Pulmonology Clinic to Pulmonary Rehabilitation Clinic per month
- Attendance rate
- Number of patients who completed all program sessions
- Waiting time from referral to first session
- Operational efficiency (Program occupancy rate)
- Quality indicator (Adherence to medical protocols)
- Readmission/Re-enrollment rate

Patient Satisfaction Indicators

- Average patient satisfaction score
- Number of complaints per month

Health System Impact Indicators

- Reduction in hospital admissions
- Reduction in emergency room visits

Clinical Outcome Indicators

- Six-Minute Walk Test (6MWT)
- COPD Assessment Test (CAT)
- Modified Medical Research Council Dyspnea Scale (mMRC)
- Indirect 1 Repetition Maximum Test (1RM)
- St. George's Respiratory Questionnaire (SGRQ)
- Modified Borg Scale (dyspnea)
- Home oxygen use reduction
- Depression Anxiety Stress Scale (DASS) or Hospital Anxiety and Depression Scale (HADS)
- Ideal Body Weight (IBW) and Body Mass Index (BMI)
- Changes in FEV1, FVC

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21. Appendixes

Appendix 1

PULMONARY REHABILITATION REFERRAL	
Name DOB	Medical record number
Address	Mobile Emergency contact:
Diagnosis:	
Comorbidities:	
Relevant Investigations (e.g. PFTs, ABGs, chest x-ray)	
Medications	
Have you discussed pulmonary rehabilitation with the patient? Yes No Will transportation be required? Yes No Referrer physician: _____ Name: Signature: Phone: Email:	

Appendix 2

6 Minute Walk Test Recording Sheet

وزارة الصحة
Ministry of Health

Patient Name: MRN:

Date:

Age:

Predicted HR max (220-age):

Initial Assessment

WALK 1

Date: _____

Time: _____

Bronchodilator/time since last dose: _____

BP	Supplemental Oxygen	Gait Aid

Time mins	SpO_2	HR	Dyspnoea	Rests
Rest				
1				
2				
3				
4				
5				
6				
Recovery 1				
Recovery 2				

Distance: _____

Limiting factor to the test:

SOB ☐ Low SpO_2 ☐

Leg fatigue ☐ Other: _____

WALK 2

Date: _____

Time: _____

Bronchodilator/time since last dose: _____

BP	Supplemental Oxygen	Gait Aid

Time mins	SpO_2	HR	Dyspnoea	Rests
Rest				
1				
2				
3				
4				
5				
6				
Recovery 1				
Recovery 2				

Distance: _____

Limiting factor to the test:

SOB ☐ Low SpO_2 ☐

Leg fatigue ☐ Other: _____

Appendix 3

Final Assessment

WALK 1

Date: _____

Time: _____

Bronchodilator/time since last dose: _____

BP	Supplemental Oxygen	Gait Aid

Time mins	SpO_2	HR	Dyspnoea	Rests
Rest				
1				
2				
3				
4				
5				
6				
Recovery 1				
Recovery 2				

Distance: _____

Limiting factor to the test:

SOB ☐ Low SpO_2 ☐

Leg fatigue ☐ Other: _____

Appendix 4

ISWT LEVEL	DISTANCE	PREDICTED VO2peak
1	0 - 30	4.4 - 4.9
2	40 - 70	5.2 - 5.9
3	80 - 120	6.2 - 7.2
4	130 - 180	7.4 - 8.7
5	190 - 250	8.9 - 10.4
6	260 - 330	10.7 - 12.4
7	240 - 420	12.7 - 14.7
8	430 - 520	14.9 - 17.2
9	530 - 630	17.4 - 19.9
10	640 - 750	20.2 - 22.9
11	760 - 880	23.2 - 26.2
12	89- - 1020	26.4 - 30.2

Appendix 5

CAT
COPD Assessment Test

ما حالة مرض انسداد الشعب الهوائية المزمن (COPD) لديك؟ قم بإجراء اختبارCOPD Assessment Test™ (CAT)

سوف يساعدك هذا الاستبيان أنت وأخصائي الرعاية الصحية على قياس تأثير COPD (مرض انسداد الشعب الهوائية المزمن) على صحتك وحياتك اليومية. ويمكن لك وأخصائي الرعاية الصحية استخدام إجاباتك ودرجاتك في الاختبار للمساعدة في تحسين إدارة مرض الانسداد الرئوي المزمن والحصول على أكبر استفادة من العلاج.

لطباعة الإستبيان رجاءً اضغط هنا اذا كنت تأمل في عمل الإستبيان بالكتابة على الورق.

لكل عنصر موجود أدناه، ضع علامة (X) في المربع الذي يصف حالتك حالياً على أفضل نحو. تأكد من اختيارك لرد واحد فقط على كل سؤال.

مثال: أنا سعيد جدًا 0 (X) 2 3 4 5 أنا حزين جدًا

	لا أسعل مطلقاً	0 1 2 3 4 5	أسعل من الكحة طوال الوقت
	ليس عندي أي بلغم (مخاط) في صدري على الإطلاق	0 1 2 3 4 5	صدري ممتلئ عن آخره بالبلغم (المخاط)
	لا أشعر بضيق في صدري على الإطلاق	0 1 2 3 4 5	أشعر بضيق شديد في صدري
	لا تجدني أتنهج عند أصعد تل أو عندما أصعد دور واحد من السلم	0 1 2 3 4 5	تجدني أتنهج تماماً عند السير لأعلى التل أو عندما أصعد دور واحد من السلم
	لا يقتصر عملي في المنزل على القيام بأي أنشطة	0 1 2 3 4 5	قدراتي محدودة كثيرا عند القيام بالأنشطة بالمنزل
	أغادر منزلي في ثقة بالرغم من حالة رئتي	0 1 2 3 4 5	لا أشعر بالثقة مطلقاً في مغادرة منزلي بسبب حالة رئتي
	أنام بعمق	0 1 2 3 4 5	لا أنام بعمق بسبب حالة رئتي
	لدي الكثير من الطاقة	0 1 2 3 4 5	ليس لدي طاقة على الإطلاق
			النتيجة الإجمالية

وزارة الصحة
Ministry of Health

Appendix 6

Arabic DASS21

اسم:_____ التاريخ:_____

اقرأ كل من النصوص التالية ثم ضع دائرة حول الرقم ٠، ١، ٢ أو ٣ الذي يبين درجة انطباق هذا الشعور عليك في الأسبوع الماضي. لا يوجد إجابات صحيحة أو خاطئة. لا تقضي وقتاً طويلاً في أي منها.

استعمل التقديرات التالية:
٠ لا ينطبق عليّ بتاتاً
١ ينطبق عليّ بعض الشيء أو قليلاً من الأوقات
٢ ينطبق عليّ بدرجة ملحوظة أو بعض الأوقات
٣ ينطبق عليّ كثيراً جداً، أو معظم الأوقات

١	وجدت صعوبة في الاسترخاء والراحة	٠	١	٢	٣
٢	شعرت بجفاف في حلقي	٠	١	٢	٣
٣	لم يبدو لي أن بإمكاني الإحساس بمشاعر إيجابية على الإطلاق	٠	١	٢	٣
٤	شعرت بصعوبة في التنفس (شدة التنفس السريع، اللهثان بدون القيام بمجهود جسدي مثلاً)	٠	١	٢	٣
٥	وجدت صعوبة في أخذ المبادرة بعمل الأشياء	٠	١	٢	٣
٦	كنت أميل إلى ردة فعل مفرطة للظروف والأحداث	٠	١	٢	٣
٧	شعرت برجفة (باليدين مثلاً)	٠	١	٢	٣
٨	شعرت بأنني أستهلك الكثير في الطاقة العصبية (شعرت بأنني أستهلك الكثير من قدرتي على تحمل التوتر العصبي)	٠	١	٢	٣
٩	كنت خائفاً من مواقف قد أفقد فيها السيطرة على أعصابي واسبب إحراجاً لنفسي	٠	١	٢	٣
١٠	شعرت بأن ليس لدي أي شيء أتطلع إليه	٠	١	٢	٣
١١	شعرت بأنني مضطرب ومنزعج	٠	١	٢	٣
١٢	أجد صعوبة في الاسترخاء	٠	١	٢	٣
١٣	شعرت بالحزن والغم	٠	١	٢	٣
١٤	كنت لا أستطع تحمل أي شيء يحول بيني وبين ما أرغب في القيام به	٠	١	٢	٣
١٥	شعرت بأنني على وشك الوقوع في حالة من الرعب المفاجئ بدون سبب	٠	١	٢	٣
١٦	فقدت الشعور بالحماس لأي شيء	٠	١	٢	٣
١٧	شعرت بأن قيمتي قليلة كشخص	٠	١	٢	٣
١٨	شعرت بأنني أميل إلى الغيظ بسرعة	٠	١	٢	٣
١٩	شعرت بضربات قلبي بدون مجهود جسدي (زيادة في معدل الدقات، أو غياب دقة قلب، مثلاً)	٠	١	٢	٣
٢٠	شعرت بالخوف بدون أي سبب وجيه	٠	١	٢	٣
٢١	شعرت بأن الحياة ليس لها معنى	٠	١	٢	٣

Appendix 7

هذا الاستبيان يساعد الطبيب لمعرفة مشاعرك وقراءة أحاسيسك ، لذا يرجى إحاطة الرقم الموازي لأفضل اختيار يصف حالتك خلال الأسبوع الماضي. ليس من المطلوب الاستغراق في التفكير لإختيار الإجابة، وإنما تفضل الإجابات العفوية التلقائية.

Hospital Anxiety Depression Scale (HADS):			من فضلك، قم بإختيار الإجابة المناسبة بوضع دائرة عليها:	
A	أشعر بالتوتر الشديد:		D	أحس بأنني هامد (فاقد للطاقة) :
	• أكثر الوقت	3		• تقريباً في كل وقت 3
	• عدة مرات	2		• في كثير من الأحيان 2
	• أحياناً	1		• في بعض الأوقات 1
	• لا أشعر بذلك مطلقاً	0		• لا أشعر بذلك مطلقاً 0
D	أنا لازلت أتمتع بالأشياء التي اعتدت أن أستمتع بها:		A	ينتابني شعور بالخوف:
	• بالتأكيد، كما كنت	0		• لا، على الإطلاق 0
	• ليس تماماً	1		• أحياناً 1
	• قليلاً	2		• كثيراً 2
	• بالكاد، على الإطلاق	3		• في أغلب الأوقات 3
A	أشعر بنوع من الخوف, وكأن شيئا مروعا على وشك الحدوث:		D	لقد فقدت الإهتمام بمظهري:
	• بالتأكيد، وبشكل مزعج	3		• بالتأكيد فقدت كل الاهتمام 3
	• نعم، ولكن أقل سوءاً	2		• أنا لا أهتم بمظهري كما يجب أن أهتم 2
	• قليلاً، لكنه لا يقلقني	1		• قد لا أعتني بمظهري كما يجب 1
	• لا أشعر بذلك على الاطلاق	0		• أعتني بمظهري بشكل جيد كما كنت سابقا 0
D	أستطيع الضحك و رؤية الجوانب المضحكة في الأشياء:		A	الإحساس بضيقة الصدر دون مجهود جسدي:
	• كما كنت سابقا	0		• في الواقع، كثيراً جداً 3
	• اقل مما كنت سابقا	1		• كثيراً، لابأس به 2
	• بالتأكيد، ليس كثيراً الآن	2		• أشعر بذلك قليلاً 1
	• لا أشعر بذلك على الإطلاق	3		• لا أشعر بذلك على الإطلاق 0
A	تأتيني دائما افكار مقلقة:		D	أنا أتطلع للأشياء من حولي باستمتاع:
	• أغلب الأوقات	3		• بقدر ما يمكنني فعله 0
	• معظم الأوقات	2		• نوعا ما أقل مما اعتدت على فعله 1
	• من وقت لآخر، ولكن ليس كثيراً	1		• بالتأكيد أقل مما اعتدت على فعلة 2
	• أحيانا	0		• لا، على الإطلاق 3
D	أشعر بالبهجة:		A	ينتابني إحساس مفاجئ بالفلع:
	• لا، على الإطلاق	3		• في الواقع، في كثير من الأحيان 3
	• ليس كثيراً	2		• غالباً 2
	• في بعض الأحيان	1		• ليس كثيراً 1
	• في أغلب الأوقات	0		• لا أشعر بذلك على الإطلاق 0
A	يمكنني الجلوس براحة و الشعور بالاسترخاء:		D	يمكنني الإستمتاع بقراءة كتاب جيد أو مشاهدة البرامج التلفزيونية أو الإستماع إلى الإذاعة:
	• بكل التأكيد	0		• غالباً 0
	• عادة ما	1		• في بعض الأحيان 1
	• ليس كثيراً	2		• ليس كثيراً 2
	• لا يمكنني ذلك على الإطلاق	3		• نادراً جداً 3

Terkawi et al. Arabic version of (Hospital Anxiety Depression Scale "HADS") Page 1 of 1

Appendix 8

Pulmonary rehabilitation program
Exercise monitoring sheet

Date	Resting			Treadmill Pre					Post			Bicycle Pre				Post		
	HR / SPO_2/RR	BP	O2 L/M	S km/h	D Km	A °	T Min	HR / SPO_2/RR	HR / SPO_2/RR	O2 L/M	Borg S	R W	D Km	T Min	HR / SPO_2/RR	HR / SPO_2/RR	O2 L/M	Borg S
/ /	/ /							/ /	/ /						/ /	/ /		
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Glossary				
HR= Heart Rate *SPO_2= Oxygen Saturation* RR= Respiratory Rate	BP= Blood Pressure L/M = Litter / minute	S=Speed D=Distance A=Angle	T= Time R= Resistance W= Watts	Borg S = Borg scale

Appendix 9

Pulmonary Rehabilitation Follow -up Report

وزارة الصحة
Ministry of Health

Physician:
Diagnosis:
Date of Starting:
End of course Date:
Number of Sessions Taken:
Session #:

Parameter	Initial	Session 1	Session 2	Session 3	Session 4	Session5	Session 6	Session7	Session 8
Oxygen saturation at rest (%)									
Number of rests during the exercise									
Oxygen saturation during exercise									
O2 L/m									
Symptoms after the exercise									
Treadmill (Time/Distance)									
Borg Scale									
Bicycle (Time/Distance)									
mMRC scale									

Appendix 10-a

KINGDOM OF SAUDI ARABIA		MRN:		رقم الملف:
وزارة الصحة Ministry of Health		Name:	.....	الاسم
Hospital	مستشفى	Nationality:	.....	الجنسية
		Age:	.....	العمر
		Date of Birth	20م /...../..... ...../...../.....H	تاريخ الميلاد
Region	المنطقة	ID	....	رقم الهوية
Dept/Unit	القسم	Gender	Male ☐ Female ☐	الجنس:
		Diagnosis	....	التشخيص:

Initial Nutritional Assessment Form

☐ Inpatient	☐ Outpatient	☐ Adult	☐ Pediatric

SUBJECTIVE

Diet History		Appetite	Complaints	
		Very good	☐ None	☐ Diarrhea
		Normal	☐ Vomiting	☐ Nausea
		Poor> 3 Days	☐ Constipation	☐ Bloating
		On tube Feeding	☐ Heartburn	☐ Weight Loss
		NPO	☐ Epigastric Pain	☐ Weight Gain
Food Allergy ☐ No ..... ☐ Yes ..... (List of Food Allergies)	Eating Difficulties ☐ None ☐ Chewing ☐ Swallowing ☐ Physical Disorder ☐ Eating Disorder	Activity ☐ Ambulatory ☐ Confined to bed ☐ paralyzed	☐ Others:	
Physician Diet Order (List of Diet Orders)				

OBJECTIVE

Laboratory Results: (to view Lab Results)			
Food – Drug Interaction : ☐ No ..... ☐ Yes ..... (List of Food-to-Drugs Interactions)	Weight	..... Kg	
	Height	..... Cm	
Nutritional diagnosis (List of Nutritional Diagnoses from ICD-10)	IBW (Equation)	BMI	
	BMI: Age > 16 = (BMI Equation)		
	BMI: Age 5-16 = (Saudi Growth Charts 5-16)		
	PERCENTILE: Age 0-5 = (Saudi Growth Charts 0-5)		
	Wt / Ht		
	Wt/Age		
	Ht/Age		

Assessment

Nutritional Requirements: (to be passed to food/kitchen services)	Nutritional Ass. (interpretation of BMI category?)
Calories: (BMR Equation)	
CHO: (Claories * 0.6)	
Prot: (Claories * 0.15)	
Fat: (Claories * 0.25)	
Water: (Fluid Equations)	
Minerals: (free text)	
Notes: (free text)	

PLAN

Type of Fedding	☐ Oral Feeding (list?)	☐ Tube Feeding (list?)	☐ Parenteral Feeding (list?)
Discharge Plan (For Inpatients Only)			

Patient and Family Education: Yes (if yes, refer to Interdisciplinary Patient Family Education Record Form) No (please state your reoson):

Clinical Dietician's Signature:	Date and Time:
Physician's Signature:	Date and Time:

Appendix 10-B

KINGDOM OF SAUDI ARABIA		MRN:	رقم الملف:
وزارة الصحة Ministry of Health		Name:	الاسم
		Nationality:	الجنسية
		Age:	العمر
Hospital	مستشفى	Date of Birth 20م /...../..... ...../...../.....H	تاريخ الميلاد
Region	المنطقة	ID	رقم الهوية
Dept/Unit	القسم	Gender Male ☐ Female ☐	الجنس:
		Diagnosis	التشخيص:

Nutritional Re-Assessment Form

☐ Inpatient	☐ Outpatient		☐ Adult ☐ Pediatric
Subjective	**Appetite**	**Complaints**	**Daily Nutritional Intake**
	☐ Very good ☐ Normal ☐ Poor ☐ On tube feeding ☐ Nil per oral (Single selection:)	☐ None ☐ Diarrhea ☐ Vomiting ☐ Nausea ☐ Epigastric pain ☐ Others	☐ Aspiration ☐ Heartburn ☐ Bloating ☐ Constipation (Multiple selection:)	☐ Adequate ☐ Improved ☐ Inadequate
Objective & Assessment	New Food – Drug Interaetion	Weight Change ☐ Yes ☐ No If Yes: Increased ☐ Decreased ☐ Total Energy Requirement:		Laboratory Results (list of Lab Results)
	Type of Fedding	☐ Oral Feeding	☐ Tube Feeding	☐ Parenteral Feeding
PLAN	**Same previous form**			
	Discharge Plan (For Inpatients Only)			
Patient and Family Education: Yes (if yes, please re,,,,,,,,,,,,,,,,,,,,,,,, No (please state your reoson):				
Clinical Dietician's Signature:		**Date and Time:**		
Physician's Signature:		**Date and Time:**		

Appendix 11

Section A: Patient Demographics

- Patient ID: _____
- Age: _____
- Gender: ☐ Male ☐ Female
- Diagnosis: ☐ COPD ☐ Asthma ☐ Post-COVID ☐ Other: _____
- Program Duration: _____ weeks

Section B: Clinical Outcome Measures

1. 6-Minute Walk Test (6MWTD)
- Distance before program: _____ meters
- Distance after program: _____ meters
- Improvement: _____ meters

2. Modified Borg Scale (Dyspnea after exertion)
Before: ___ /10 — After: ___ /10
3. CAT Score (COPD Assessment Test)
Before: ___ /40 — After: ___ /40
(Lower score = better quality of life)

Section C: Program Satisfaction (Scale 1–5: 1=Strongly Disagree, 5=Strongly Agree)

STATEMENT	1	2	3	4	5
The program improved my breathing and stamina.					
The schedule was convenient for me.					
Staff were knowledgeable and supportive.					
I feel more confident managing my lung condition.					
Facilities and equipment were clean and well-maintained.					
I would recommend this program to others.					

Section D: Open Feedback

- What did you like MOST about the program?
- What could be IMPROVED?
- Additional comments: